

OBITUARY NOTICES OF FELLOWS DECEASED.

HUGO VON MOHL, born April 8, 1805, was the fourth of five brothers, all of whom were men of note, either for public services or intellectual ability. His father was some time Minister at Wurtemberg for Home Affairs and Worship, while his mother, a person of exceptional gifts, was the daughter of Autenrieth, Finance Minister in the same State.

Von Mohl's early education was obtained at the Gymnasium of his native town, Stuttgart. In his nineteenth year (1823) he entered the University of Tübingen, where (in 1828) he graduated in medicine. In his inaugural dissertation (alluded to below) he clearly foreshadowed the course in science in which he was to preeminently excel. It was his father's wish that he should devote himself to surgery. This, however, was distasteful to him; and the intercourse into which he was thrown during the next few years with Von Martius, Zuccarini, Steinheil, and other botanists, soon determined the direction of his pursuits. In 1831 he contributed to the great work of Martius on Palms a memoir on the structure of the stems of those plants. In this year he was nominated first "adjunct" to the Botanic Garden of St. Petersburg, a post which, however, he did not accept, owing to his being appointed Professor of Physiology at Bern, whither he went in 1832. After the death of Schübler he returned, in 1835, to Tübingen as Professor of Botany in the University; and here he remained, notwithstanding many brilliant proposals tempting him elsewhere, till the time of his death. The interests of the University of Tübingen were matters about which he felt a keen solicitude, and the foundation of a Faculty of Natural Science in that University was essentially his work. In 1843 the Order of the Crown of Wurtemberg was conferred on him and he was ennobled. About this time he was obliged to make a prolonged stay in South Tyrol on account of delicate health. He recovered; but although a man of great stature and robust build, he appears, after he had accomplished his sixtieth year, to have fallen into chronic ill health. He suffered from pleurisy and attacks of diarrhœa. Eventually he became very reserved in manner and subject to giddiness. On the morning of Easter Monday, April 1, 1872, having been cheerful and well the night before, he was found dead in bed.

These particulars are derived from the memoir which appeared in the 'Botanische Zeitung' for 1872. Von Mohl was elected a Foreign Member of the Royal Society, March 26, 1868.

In describing fully Von Mohl's scientific career and position, it would be necessary to write the history of vegetable histology. His work is practically coincident with the application of the higher powers of the microscope to the investigation of vegetable tissue. Confining himself almost exclusively to the higher classes of plants, from the group of Muscineæ upwards (and neglecting the Algæ, Fungi, and Lichens), there is hardly a point of any consequence in which some research or investigation

of Von Mohl's is not the solid foundation of our present knowledge. The Catalogue of Scientific Papers of the Royal Society enumerates 78 of his papers—not including various dissertations, some of which, along with a selection of the more important of his papers, were in 1845 collected and published in a quarto volume, under the title of “*Vermischte Schriften.*” The list of his publications which accompanies the memoir in the ‘*Botanische Zeitung*’ gives the titles of no less than 90. Nor were his own labours the only way in which he contributed to the advancement of our knowledge of the minute anatomy of plants. In 1843 he commenced, in conjunction with Schlechtendal, the ‘*Botanische Zeitung*,’ a small quarto weekly periodical of eight pages, occasionally illustrated with plates, which he continued to edit till the time of his death. The volumes of this journal chronicle, year by year, the gradual development of the microscopic study of plants, a field in which (doubtless in no small degree owing to the example of Von Mohl) German science has reaped a more abundant harvest than that of other nations. No one can fail to be struck with the thorough character of Von Mohl's scientific work. His energies were always ready to turn themselves to any part of his subject where facts seemed to need investigation, or the results of others to challenge reexamination or criticism. His papers are, in their way, models of “contributions to knowledge.” Except when they are controversial, they always commence with a careful history and estimate of the work of previous investigators of the particular subject under consideration.

Von Mohl's first publication in 1827 was a prize thesis on the structure of climbing plants, in which he endeavoured to show that the stems have a dull kind of irritability, so that they bend towards any object which they touch. This explanation has given place to a better knowledge of the phenomena; but Mr. Darwin, to whom that service to science is largely due, bears witness to the *primâ facie* probability of Von Mohl's view (Journ. Linn. Soc., Bot. vol. ix. p. 10). His inaugural dissertation in 1828 (already alluded to) gave the first account of the true structure of the dots or “pores” frequently met with in the walls of cells (‘*Ueber die Poren des Pflanzenzellgewebes*’). He showed that they were thinner portions of the cell-membrane.

In 1831 Von Mohl, as already mentioned, contributed to the ‘*Historia Naturalis Palmarum*’ of Von Martius an elaborate account in Latin of the structure of the stems and roots of palms, under the title “*De Structura Palmarum.*” This was republished in German in his ‘*Vermischte Schriften*’ in 1845, and was translated for the Ray Society in 1849 by Prof. Henfrey. Von Mohl gave the final blow to the theory of the internal growth of monocotyledonous stems first propounded by Desfontaines, and upon which De Candolle had founded the division of vascular plants into Exogens and Endogens. In this memoir he appears to have first described the origin of ducts from rows of closed cells, a point which he further developed in the following year in a paper, “*Ueber den Bau der porösen Gefässe.*”

In 1832 he also described the movements due to irritability in various species of *Robinia*. In a paper on Lenticels he disproved the theory of De Candolle that these structures were in any way dependent on the production of adventitious roots. His memoir on the stems of Cycads appeared also this year.

In 1833 he worked out the anomalous structure of the stomata in the Proteaceæ, which Robert Brown had regarded as imperforate and had described simply as "glandulæ cutanææ." He contributed to the 'Icones Plantarum Cryptogamicarum Brasiliæ' of Von Martius a description of the anatomy of the stem of tree ferns. Hitherto the course of their vascular bundles had been supposed to be very similar to that of Monocotyledons. Von Mohl was the first to explain the structure of the hollow fenestrated cylinder into which the bundles are combined, and subsequent observers have added little to his account. In a memoir published in the 'Flora' he described the development of the spores in various of the higher Cryptogams. He gave the first accurate account of the development of the moss-capsule, pointed out the development of the spores in fours in one mother-cell, explained the development of the elaters of *Jungermannia*, and gave a correct account of those of *Equisetum*.

In 1834 he published an elaborate paper on pollen, in which he detailed an immense number of observations. It is true he fell into error in regarding the external coat as in some cases itself cellular. On the other hand, he was able to correct Robert Brown, who, in describing the peculiar movements (which have been called after him) in the granules of the fovilla of pollen, attributed to the granules at the same time a change of form. Von Mohl also established the development of the pollen-grains in fours within each mother-cell, thus indicating an analogy with the development of spores in Cryptogams.

The publication by Von Mohl in 1835 of his discovery of the multiplication of cells by division ('Ueber die Vermehrung der Pflanzenzellen durch Theilung') in *Cladophora glomerata* has been the starting-point of all subsequent investigations into the development of the tissues and organs of plants. It revealed, in fact, the precise mode by which vegetative growth is accomplished. Mirbel, in his memoir on the development of *Marchantia*, communicated to the Académie des Sciences in 1831 and 1832, but not published till 1836, had described the formation of pollen-grains by the quadripartite division of a mother-cell. This, however, though an extremely important observation, is not a case of growth, properly speaking, and does not affect Mohl's historical position in the matter. In 1838 Schleiden announced the multiplication of cells by the formation of new cells *in their interior* as a general law in the vegetable kingdom. He was supported by Nägeli. The views of Von Mohl, developed as they were by Meyen and Unger, eventually established themselves. In a paper on the structure of cork and bark, Von Mohl described the nature of the tissues which enter into their composition, and accounted for the

diversity of their character in different plants, especially the enfoliation of layers of bark in such trees as the Plane.

The following year (1836) Von Mohl developed his theory of an inter-cellular substance in which the cells of tissues were held to be imbedded. This supposed cement is now known to belong to the cell-walls themselves, and not to be a substance independent of them. Mohl indeed, later in life, practically withdrew his views upon the matter ('Die vegetabilische Zelle,' 1850). He also, in 1836, gave an account of the singular caudex of *Tamus* (*Testudinaria*) *elephantipes*.

In 1837 Von Mohl published the results of his investigations with regard to chlorophyl. They still remain essentially undisturbed. He showed that chlorophyl-granules were soft and homogeneous bodies, and not vesicular, as had been supposed; he detected in them the presence of starch. Nägeli having asserted that chlorophyl-granules possess a cellulose investment, Von Mohl returned to the subject in 1855, and showed that this view was untenable. During 1837 he also published a dissertation on the structure of vegetable membrane, in which he declared "secondary cell-membranes to possess a fibrous structure." The objective fact observed by Von Mohl is one of very general truth, although a rather different set of considerations are now brought to its explanation. His paper on the porous cells of *Sphagnum* finally put to rest the controversy as to their nature. He contributed an examination of some abnormal cones to the difficult question of the floral morphology of Coniferæ. In his observations on the sporangium in the vascular Cryptogams he established the real nature of this structure in ferns. In the case of *Selaginella*, Bischoff's view, that the sporangium is an axillary bud, was abandoned by Hofmeister for the explanation given by Von Mohl.

In 1838 he published the first account of the development of stomata, which he observed in *Hyacinthus orientalis*. He also corrected the account which Mirbel had given of the origin of the stomata of *Marchantia*. His dissertation, 'Ueber den Einfluss des Bodens auf die Vertheilung der Alpenpflanzen,' has served as a basis for the more extended investigations of Alphonse De Candolle on the same subject.

In 1839 he discussed the structure of annular vessels, contending against Schleiden that they were not a derivative form of spiral vessels. In his 'Die vegetabilische Zelle' he maintained a similar view with regard to reticulated and other vessels. He published some important observations on the development of the spores of *Anthoceros*.

In 1840 he described the peculiar phenomena of the growth of *Isoetes*; and, as Hofmeister has remarked ('On the Higher Cryptogams,' p. 337), "since Von Mohl's discoveries the special attention of botanists has been almost constantly directed to this interesting family."

In 1842 he published remarks on the structure of dotted ducts. In this he gave the first explanation of the structure of *bordered* pores. In the corrected form given to it by Schacht (1859) this is probably the

final account of the matter. In the same year he published his investigations on the cuticle of plants, which he demonstrated to be organically derived from the epidermic cells. He further supported this view in papers published in 1847 and 1849.

Von Mohl's researches in 1843 ('Ueber den Milchsafft und seine Bewegung') demolished Schultz's analogy of latex to blood. They were published in the 'Botanische Zeitung,' which was started in this year.

In 1844 Von Mohl maintained, against the theory of Dupetit-Thouars, the dependence of the growth of Dicotyledons on the physiological activity of leaves. The same year he published his remarks on the structure of the vegetable cell, which for a long time immensely influenced the course of vegetable histology. He regarded the cell-wall as generally composed of a primary external imperforate membrane, and a secondary one usually perforated with apertures. This he supposed to be lined by a third membrane, "Primordialschlauch," the primordial utricle of English writers. "This membrane forms a perfectly closed, cell-like, thin-walled vesicle, which in the fresh plant is closely applied to the inner wall of the cell, and therefore escapes observation; while in specimens which have been preserved in spirit it is contracted, and more or less detached from the wall of the cell."

In 1845 Von Mohl published a memoir on the Flora of Wurtemberg. It is interesting to find a great physiological botanist engaged in work of this kind, which it is rather the fashion at present to depreciate. Von Mohl enters at some length into the causes which influence the local distribution of plants; and it is in regard to points of this kind that he attaches scientific importance to local floras. An examination of a monstrous state of *Poa alpina* led him to the now generally received opinion that the lower floral glume of grasses is not a perigonial leaf but a bract. To the same year belongs a paper on the penetration of cuticle into stomata.

Von Mohl's paper, "Ueber die Saftbewegungen im Inneren der Zellen," published in 1846 (Bot. Zeit. p. 73), has been the starting-point of all modern views about the vegetable cell. He first described accurately the "opaque viscid fluid of a white colour, having granules intermingled with it, which fluid I call *protoplasm*." He observed the vacuolization of the protoplasm until it forms a mere network. He described the motion which takes place in the filament of the network, "or perhaps now first becomes visible," and he measured its rate. Schleiden gave the theory its finishing touch in the third edition of his 'Principles' (1849), by identifying Mohl's primordial utricle and circulating fluid.

In 1847 Von Mohl confirmed the researches of Amici (for whom he had a high regard) on the impregnation of Orchideæ, which, in his judgment, made an end of Schleiden's theory as to the origin of the embryo in Phanerogams, although the controversy was carried on for some time longer by Hofmeister, Tulasne, Schacht, and Radlkofer. He also published an elaborate memoir, which has been translated into both French

and English, in which he discusses against Mulder the value of the combined action of sulphuric acid and iodine as a colour-test for cellulose, his object being to insist on that substance being regarded as the basis of all vegetable membrane.

In 1850 he experimented with Hoffman on the function of vessels, but with contradictory results.

He pointed out in 1851 that the formation of chlorophyl is in intimate relation with protoplasm, portions of which it tinges in making its first appearance.

In 1852 he published a short paper on the grape-mildew.

In 1855 his researches on the structure of "liber" brought out some entirely new facts. He had already been the first (in 1836) to examine bast-cells with care. He pointed out that bast-cells were far from being so exclusive a constituent of the liber as had been supposed, and that they were often accompanied, or even entirely replaced, by the "Gitterzellen." His study of the causes of the opening and closing of stomata in 1856 was the first systematic examination which the question had received. It cleared up the apparent contradiction of the results obtained by Sir Joseph Banks on the one hand, and Moldenhawer on the other.

In 1857 Von Mohl discovered the extremely curious fact that the substance known as "gum tragacanth" is produced by the alteration of the cells of the pith and medullary rays of various species of *Astragalus*.

Passing over contributions of minor importance, Von Mohl published in 1870 a short discussion of the passages in the writings of Linnæus which have been held to indicate a foreshadowing in his mind of the theory of descent.

The last paper which appeared in Von Mohl's lifetime was on an extremely suggestive subject, the morphology of the foliar organs of the umbrella-pine of Japan (*Sciadopitys*). The microscopic structure of these organs led him to compare them to two consolidated leaves with the organic underside turned uppermost. They therefore suggested an analogy with the *squamæ fructiferæ* of Coniferæ generally, upon the true nature of which they have therefore been held to throw an important light.

In 1850 Von Mohl published a small work with the title "Die vegetabilische Zelle," which weaves the results of a great deal of what he had written in scattered memoirs into a continuous whole. It was translated into English by Prof. Henfrey in 1852.

Von Mohl felt the greatest interest in improving the means of histological and anatomical research, and wrote several papers on the construction and use of optical instruments, and in 1846 published a book on micrography.

Dr. ROBERT EDMOND GRANT was the seventh son of Alexander Grant, Esq., Writer to the Signet. He was born in his father's house in Argyle

Square, Edinburgh, on the 11th of November, 1793. His mother's maiden name was Jane Edmond. It appears, from a memorandum in Dr. Grant's handwriting, that he was sent from home to be nursed, and saw little of either of his parents during his infancy and childhood. He had eight brothers and three sisters, all of whom died before him; and as none of them left any children, Dr. Grant was the last survivor of his family.

When about ten years old he was placed at the High School of Edinburgh, where he continued for five years, under the tuition, successively, of Mr. Christison (afterwards Professor in the University), Dr. Carson, and Dr. Adam, the Rector, author of the well-known work on Roman Antiquities. In 1808 his father died; and in November of that year Dr. Grant became a student in the University of Edinburgh, attending the junior classes of Latin and Greek. In the following November he entered on his curriculum of medical study, and during its course attended the several classes in the Faculty of Medicine under the Professors of that day. He also studied Natural History under Professor Jameson, and attended the lectures of some of the extra-academical teachers. After completing his course of medical study, he in 1814 took his Degree of Doctor of Medicine, and published his inaugural dissertation, "*De Sanguinis Circuitu.*"

In the mean time he had obtained (in May 1814) the Diploma of the College of Surgeons. In November of the same year he was elected one of the Presidents of the Medical Society of Edinburgh, a place justly regarded as an honourable object of ambition among the young aspirants in the Medical School.

Rather more than a year after taking his degree Dr. Grant went to the Continent, where he spent upwards of four years. During this time he visited various places of interest in France, Italy, and Germany, and made a pedestrian tour in Hungary; but his principal stay was in Paris, Rome, Leipsic, Dresden, Vienna, and Munich, on account, no doubt, of the varied opportunities for scientific study and general culture afforded by these foreign seats of science, art, and learning. He returned to Edinburgh in the summer of 1820, and took up his residence in his native city. At a later time he became a Fellow of the Edinburgh College of Physicians; but he seems not to have engaged in medical practice—his career had taken another direction. He had early imbibed a taste for Comparative Anatomy and Zoology, and now devoted himself assiduously to the prosecution of those branches of science, both by continued systematic study and by original research. The study of the invertebrate animals was peculiarly attractive; and at this time Dr. Grant published various interesting anatomical and physiological observations on mollusks and zoophytes; and his name will always be associated with the advances of our knowledge concerning the structure and economy of sponges, to the investigation of which Dr. Grant at this time enthusiastically applied himself. The pools left by the retiring tide on the shores of the Firth of

Forth afforded favourable opportunities for observation ; and he would spend hours patiently watching the phenomena exhibited by these humble organisms in their native element.

Dr. Grant remained in Edinburgh till 1827, and in the mean time communicated the results of his various scientific inquiries to the 'Edinburgh Philosophical Journal' and the 'Memoirs of the Wernerian Society,' of which he became an active member. He was also (in 1824) elected a Fellow of the Royal Society of Edinburgh.

In June 1827 Dr. Grant was elected Professor of Comparative Anatomy and Zoology in the newly founded University of London, afterwards University College. He was not altogether new to the work of teaching. He had some early, though brief, experience in Edinburgh, in 1824, when Dr. Barclay, who for some years had delivered lectures on Comparative Anatomy during the Summer Session, entrusted him with the part of the course which related to the anatomy of invertebrated animals. He entered on his duties in London in 1828, and in October of that year delivered his inaugural lecture, which was published at the time and went through two editions. In this office he continued up to the time of his death, during which long period of forty-six academical years he never omitted a single lecture. This was a point on which he justly prided himself. Up to the last Session (1873-74) he continued to give five lectures a week ; but, sensible of failing strength, he proposed to reduce the number to three in the next Session (which he was not destined to see). The number of pupils in his class fluctuated a good deal, but was never large, attendance not being compulsory in the Medical Curriculum prescribed by the Licensing Corporations. In one Session the number was fifty-six, but usually it was between thirty and forty, and sometimes much less.

After he had thus laboured for more than twenty years, the Council of the College added to the small return he received for his services an annual stipend of £100, which was continued during the rest of his incumbency. About the same time a number of his friends, in presenting him with a microscope in testimony of their esteem, purchased for him a Government Annuity of £50. Afterwards he succeeded to some property left by his brother Francis, an officer in the Madras Army, who died in 1852 ; so that in his latter years he found himself in easy circumstances.

His leading pupils were much attached to him, and he was sincerely esteemed and respected by all. His style of lecturing was clear and impressive, with a ready and copious flow of language. Without meaning to speak of his mode of treating his subject, we may nevertheless remark that on one great biological question (the origin of species) he was from the first an evolutionist, and on the promulgation of the Darwinian hypothesis of natural selection he became one of its warmest adherents.

In 1833 Dr. Grant delivered a gratuitous course of forty lectures on the structure and classification of animals to the members of the Zoolo-

gical Society. In 1837 he was appointed Fullerian Professor of Physiology in the Royal Institution, which office he held for the usual period of three years. At a later time he was appointed by the Trustees of the British Museum to the Swiney Lectureship on Geology, the tenure of which is limited to five years. In 1841 he delivered the Annual Oration before the British Medical Association. In 1836 he was elected a Fellow of the Royal Society of London. He was also a Fellow of the Linnean, Zoological, and Geological Societies.

Dr. Grant's vacations were spent sometimes in Scotland, but chiefly abroad, in France, Germany, Belgium, and Holland. On more than one of these occasions he was accompanied by an intelligent and favourite Hindoo pupil, Dr. Chuckerbutty, who afterwards became a Professor in the Government Medical College of Calcutta. Dr. Grant seems to have had a special liking to Holland, which he visited and revisited several times—partly, no doubt, on account of its scientific institutions and zoological museums, but largely also for the sake of acquiring the Dutch language. In like manner he afterwards spent his vacation in Copenhagen, and worked hard at Danish. Indeed it is to be noted that he had a great taste for the study of languages, both practical and philological, and spoke the principal European tongues fluently.

Dr. Grant's lectures were reported in the early Numbers of the 'Lancet' (1833-34), and he afterwards published a treatise on Comparative Anatomy which embodied the substance of them. The work came out in parts, but was not completed. He was also author of the article "Animal Kingdom" in Todd's 'Cyclopædia of Anatomy.' The titles and dates of his communications to periodical works are given in the Royal Society's 'Catalogue of Scientific Papers.' They are 35 in number, and extend from 1825 to 1839.

Dr. Grant was a devoted lover of music, and attendance at operas and concerts was one of his chief enjoyments in his latter years.

In August 1874 Dr. Grant suffered from a dysenteric attack, for which at first he would have no medical advice; and although subsequently, by appropriate treatment, the virulence of the disease was subdued, his strength was exhausted, and he died on the 23rd of that month at his house close by Euston Square. He was buried in Highgate Cemetery, attended to the grave by a few old friends and attached pupils, among whom was his friend and former companion in travel, Dr. Chuckerbutty, who was then in England, and two months later was destined to follow his venerated master.

Dr. Grant was never married. He knew of no surviving relatives. Three of his brothers, whose deaths he has recorded, were military officers. Of these, James, a lieutenant in the German Legion, fell at the siege of Badajoz in 1811; Alexander, captain in the Madras Engineers, died in the Burmese war in 1825; and Francis, captain in the Madras Army, as already mentioned, died at Edinburgh in 1852.

By his will Dr. Grant bequeathed the whole of his property, including

his collections and library, to University College, in the service of which he had spent the greater part of his life, and to the principles of which he was sincerely attached.

Sir JOHN RENNIE, C.E., past President of the Institution of Civil Engineers, was born August 30, 1794. He first assisted his father, the late John Rennie, in building both Southwark and Waterloo bridges. After the death of his father in 1821 he succeeded him as Engineer to the Admiralty, a post he held for ten years. Among his more important works are London Bridge (for which he received the honour of knighthood), Sheerness Dockyard, the completion of Ramsgate Harbour and Plymouth Breakwater (commenced by his father), the Earl of Lonsdale's Docks at Whitehaven, a portion of those at Cardiff, and the carrying out for a number of years of the great system of drainage and land reclamation in the Lincolnshire fens, also works at Newry and Dundalk. He was the author of a noble work on Harbours, of which Her Majesty was graciously pleased to accept the dedication, and for which he received tokens of honour from their Imperial Majesties the Emperors of Russia and Austria; also of a monograph on Plymouth Breakwater, and a small History of Engineering in the form of a Presidential Address to the Institution of Civil Engineers. In conjunction with his late brother, G. Rennie, he contributed to introduce the screw-propeller into the navy, and erected the machinery for the mints of Calcutta, Bombay, and Mexico; they also erected the Royal Clarence Victualling Yard at Plymouth; and Sir John Rennie was the first to perceive the uses of the diving-bell in engineering works. Sir John Rennie was admittedly the highest authority on all subjects connected with hydraulic engineering, harbours, drainage, canals, irrigation, the storage of water, and the management of rivers; and his pamphlets on the drainage of Lombardy having attracted notice, the Italian Premier, Signor Sella, advised His Majesty the King of Italy to confer upon him the Order of St. Maurice and St. Lazare. Sir John long possessed a wide reputation on the Continent, as may be gathered not only from the above remarks, but from the fact that he constructed the harbour of Ponte Delgada in the Azores, that he was a Knight of the Tower and Sword of Portugal, of the Wasa of Sweden, and was also a Member of the Academy of Sciences of Stockholm and of the Austrian Society of Civil Engineers. Sir John was, further, well versed in general science and literature; and besides belonging to most of the scientific and learned societies in the metropolis, he was long an active Member of the Royal Society and the Meteorological Committee and one of the Council, and was also Chairman of the Juries at the Exhibition, 1862. Of late years, owing to age and increasing infirmities, he retired almost entirely from active life and public notice, and finally died, September 3, 1874. His kindness of heart won him many friends, who will greatly regret his loss.

LAMBERT ADOLPHE JACQUES QUETELET was born at Ghent on the 22nd of February, 1796. He had the misfortune of losing his father at the early age of seven; and the poverty of his family obliged him to seek his own livelihood at once on leaving the Lycée. He obtained an appointment as teacher of mathematics, drawing, grammar, &c. in a school at Oudenarde. At the end of a year he returned to Ghent; and in February 1815, the very day on which he completed his nineteenth year, he was appointed to the Chair of Mathematics at the New College, which had replaced the Lycée. This appointment was not a brilliant one; but with the private lessons which he had the opportunity of giving, it afforded him a subsistence, and he had the satisfaction of feeling himself independent. He had even some leisure to devote to science, his flute, drawing, and to literary composition. About this time he, in conjunction with his intimate friend and former schoolfellow Dandelin, wrote an opera, entitled “Jean Second ou Charles Quint dans les murs de Gand,” which was favourably spoken of. Dandelin soon afterwards left Ghent; and Garnier, who had become Professor of Mathematics at the University of Ghent, persuaded Quetelet to return to science. He studied the higher mathematics under Garnier, and at the same time assisted the latter by giving some of his lectures.

In 1819 he took the degree of Doctor of Science, the first conferred in that University. On this occasion he gave a brilliant inaugural address, in which he made known his discovery of a new curve of the third degree.

This discovery of the “focale” was much noticed in the ‘*Annales Beligues*’ and in the ‘*Mercure Belge*,’ and was spoken of by Garnier and Raoul as a great honour to the newly founded university.

At the beginning of August, M. Falck, Minister of Public Instruction, came to Ghent, and was present at the laying of the first stone of the New University Buildings. Quetelet was on this occasion presented to M. Falck, and the strong recommendation of him by two such men as Garnier and Raoul led to his appointment shortly afterwards to a Professorship of Elementary Mathematics at the Athenæum of Brussels.

This appointment was made in the beginning of October; and by a private arrangement Quetelet engaged to give one quarter of his salary to his aged predecessor, M. Delhay, as a retiring pension.

In Brussels Quetelet soon became intimate with the French refugees, David, Arnault, &c., besides frequenting the society of artists and literary men, and the theatres, where Talma, Mademoiselle Mars, &c. gave a series of performances each year.

At this period he composed various verses, and published, in the ‘*Annales Beligues*,’ in the year 1825, an “*Essai sur la Romance*.”

On the 24th of February Quetelet was made a Member of the Royal Belgian Academy of Science, receiving the diploma from Van Hulthem.

The first memoir he presented to the Academy, after his reception, VOL. XXIII. c

was on the 14th of October, 1820, and was entitled "Mémoire sur une Formule Générale pour déterminer la surface d'un polygone formé sur une sphère par des arcs de grands ou de petits cercles, disposés entre eux d'une manière quelconque."

The following are the titles of other papers, also read in the Academy, between December 1820 and February 1826 :—

"Sur les Conchoïdes Circulaires." Note to "Mémoire sur les Caus-
tiques." "Mémoire sur une nouvelle manière de considérer les Caus-
tiques, produites soit par Réflexion, soit par Réfraction." "Résumé
d'une nouvelle Théorie des Caus-
tiques, suivi de différentes applications
à la théorie des projections stéréographiques." "Démonstration et déve-
loppements de la théorie des Caus-
tiques secondaires."

Quetelet's researches, already noticed by Gergonne and other distin-
guished geometers, were particularly remarked on by Chasles, after
the 'Correspondance Mathématique et Physique' had given them greater
publicity.

Two other memoirs by Quetelet, inserted in the collection of the
Academy, still remain to be noticed—the "Mémoire sur quelques con-
structions graphiques des orbites planétaires" and the "Mémoire sur
différents sujets de Géométrie à trois dimensions."

The 'Correspondance Mathématique et Physique,' already mentioned,
was commenced by Garnier and Quetelet early in the year 1825. Its
contributors were dispersed after 1830, and it came to an end in
1839.

In 1822 Quetelet went, at the request of the Academy, with M.
Kickx to explore the celebrated grotto known as the Trou de Han, and
they drew up a report with plates.

In 1824 it was proposed that Quetelet should extend his teaching at
the Athenæum, so as to include Elementary Physics, Natural History,
and Chemistry. About the same time M. Thiry, Professor of the Higher
Mathematics, resigned his post ; and during the session 1824 and 1825
we find Quetelet teaching at the Athenæum the Descriptive Geometry
of Monge, the Theory of Shadows and Perspective, and the Calculus of
Probabilities of Lacroix. He also gave public lectures at the Museum on
Experimental Physics and on the Elements of Astronomy, which he had
substituted for Natural History and Chemistry. He had two classes,
which he conducted simultaneously in adjoining rooms, passing from one
to another, and perfect order is said to have reigned in each. His teaching
is described as simple and natural : his arithmetical instruction was
founded on a few general principles ; and as soon as his pupils were ini-
tiated into algebraic notation and its first rules, he showed them how
this admirable instrument could be made to solve ordinary problems.
His talent for drawing was evident in his manner of tracing his geomet-
rical figures.

His courses of Physics and Astronomy at the Museum attracted large

audiences of all classes of society. He had a true gift for exposition, and could with very simple apparatus make himself clearly understood. In fact he objected to complicated instruments, and said of them that they often serve only to distract the attention from the results which it is the object of the lesson to explain.

Quetelet composed several elementary works for his public courses of instruction. The first in date, "On Elementary Astronomy," appeared in 1826 at Paris, in the 'Bibliothèque Industrielle de Malher,' and was frequently reprinted in France and Belgium, and translated into several languages. In 1827 he published a much more complete work, his 'Astronomie Populaire.' This latter was shortly followed by 'Les Positions de Physique,' which is considered superior to the 'Astronomie.' He endeavoured subsequently, in a little volume entitled "De la Chaleur," to put into practice his idea of founding instruction in Elementary Physics on experiments within reach of all. His intention was to follow this up by similar treatises on Magnetism, Electricity, and Light. Quetelet wrote the chapter on Acoustics in the 'Physique,' contributed by M. Plateau to the 'Encyclopédie Populaire.' Finally, he published in 1828 'Instructions Populaires sur le Calcul des Probabilités,' which was a *résumé* of the lessons he had been giving for several years at Brussels.

His public courses of lectures had been more and more successful ever since 1824. The government now deemed it advisable to organize other lectures of the same kind; and towards the end of 1826 the Administrator General Van Ewyck requested of Quetelet, on the king's behalf, a report on the matter, and on the 17th December the Museum of Science and Literature was established by a royal decree at Brussels. Quetelet was chosen for the Chair of Physics and Astronomy; but as he already gave courses of lectures on these subjects in his capacity of Professor at the Athenæum, he obtained leave to give a course on the History of Science at the Museum. He did not, however, long continue to give this course, as he left the Athenæum at the beginning of the year 1828, when he transferred his courses of Physics and Astronomy, which he had been giving at the latter institution, to the programme of the Museum, and these he continued to give until the close of the session 1833 and 1834.

The usefulness of the Museum was much diminished by the Revolution of 1830; and after languishing for a few years that institution was finally absorbed in 1834 by the Free University. A proposal was made to Quetelet to join the Free University; but this he declined, stating that he considered such an appointment to be inconsistent with his duties at the Observatory, to which he had been appointed on condition of not taking any other. He proposed, however, to continue his courses at the Observatory, those of Physics and Meteorology during the winter, and that of Astronomy during the summer evenings. This proposal was not acceded to; and Quetelet for a short time gave up public teaching, in

which he had already been engaged for twenty years. He, however, soon entered on it again, for, by a royal decree, Jan. 6, 1836, he was appointed Professor of Astronomy and Geodesy at the *École Militaire*. During this time he paid much attention to falling stars, and gave a method for determining the height of *aérolites*, by making simultaneous observations from different points. He also made experiments on the declination and inclination of the needle.

Quetelet had very earnest views on the subject of education, and he had twice occasion to make them publicly known—once under the Government of the Low Countries, once after the Revolution of 1830.

In the Commission instituted by King William in 1828, he was one of the small minority who wished to emancipate public instruction. He demanded a reduction of the number of Universities, and the establishment of two Polytechnic Schools—one for the northern provinces of the kingdom, the other for the southern provinces. Finally, he maintained that the time had come for substituting the use of modern languages for that of Latin, still in use.

Between 1823 and 1832 Quetelet was much occupied with Statistics; and the papers he published on this subject have perhaps contributed more than any others to popularize his name.

The first memoir was read to the Academy, and entitled “*Mémoire sur la loi des naissances et de la mortalité à Bruxelles.*”

The second, also read to the Academy, “*Recherches sur la population, les naissances, les décès, les prisons, les dépôts de mendicité, &c. dans le Royaume des Pays-Bas.*”

A third, also read to the Academy, “*Recherches Statistiques sur le Royaume des Pays-Bas.*”

No new memoir appeared in 1830; but during the years 1831 and 1832 he devoted most of his time to Statistics, and published the following five memoirs on the subject:—

“*Recherches sur la loi de croissance de l’homme.*” “*Recherches sur le penchant au crime aux différents âges.*” “*Recherches sur le poids de l’homme aux différents âges.*” “*Recherches sur la reproduction et la mortalité,*” conjointly with M. Smits. “*La Statistique des Tribunaux de la Belgique pendant les années 1826 à 1831.*”

In the memoir “*Sur le penchant au crime,*” Quetelet worked out some of the ideas already made known by “*Les Recherches Statistiques sur le Royaume des Pays-Bas.*”

He passed in review the different causes tending either to develop or to lessen the disposition to crime, and denied that instruction in reading and writing had the purely beneficial influence usually ascribed to it.

In enumerating his works we must not omit two other papers:—

“*De l’influence des saisons sur les facultés de l’homme,*” and “*Sur la possibilité de mesurer l’influence des causes qui modifient les Éléments Sociaux.*”

Quetelet had been deputed by Government to attend the Meeting of the British Association for the Advancement of Science which was to be held at Cambridge, beginning on the 25th of June, 1833. He went by Paris, where he read at the Institute his memoir on Mortality.

At Cambridge he took a warm interest in the establishment of the Statistical Section, of which Malthus, Babbage, and other *savants* became members.

In London he was summoned before an Inquiry Commission instituted by Parliament, to furnish information on the mode of keeping the Civil Registers of Belgium, and on the Census of the 1st of January, 1830.

Quetelet was one of the most active members of the Academy of Sciences at Brussels, and was always very desirous of promoting its independence. In 1834 he was appointed Permanent Secretary.

In 1835 he brought out an 'Annuaire de l'Académie.' About this time also he wrote for the British Association a paper of great interest, entitled "Aperçu de l'état actuel des Sciences Mathématiques chez les Belges."

Quetelet was appointed by the House of Representatives one of the Central Jury of Science. He retained these functions for some time, and showed great kindness and sagacity in discharging them.

In the course of the year 1835 there appeared at Paris the chief of all Quetelet's works, "Sur l'homme et le développement de ses facultés, ou Essai de Physique Sociale." It was a *résumé* of all his previous works on Statistics.

In February 1836 Quetelet was charged with the execution of a Royal Decree for the establishment of a little meridian in the cities of Antwerp, Ostend, Bruges, Ghent, and Liège, and for placing a meridian-instrument on the walls of the Cathedrals, Hôtels de Ville, or other suitable buildings of forty-one different towns.

In August 1839 Quetelet made a journey, in company with his wife, in France, Italy, and Tyrol. His object was threefold. In the first place, he was to compare, in conjunction with his fellow commissioners, Messrs. Dumortier and Teichman, the standard weights and measures of Belgium with those of France; secondly, he was to attend the Congress of Savants at Pisa; and thirdly, he purposed to revise the determinations of magnetic intensity obtained in 1830, of the correctness of which he entertained some doubts.

At the sitting of the 7th December the Academy received a report of the proceedings of the Commission in the month of August; and Quetelet also presented the results of the Magnetic Observations which he had made in Tyrol and Italy.

In 1839 Quetelet communicated to the Academy a new Catalogue of the most remarkable appearances of falling stars—the second which he had made, for he had early turned his attention to this subject. He

appears, however, to have been in some uncertainty as to the nature of these phenomena.

The year 1839 was marked at the Observatory by the commencement of the observations on the flowering of plants, and in the month of January was begun the first of a series of monthly magnetic observations. These last observations were made at the suggestion of the Royal Society of London. It was in the year 1839 that Quetelet was elected a Foreign Member of the Royal Society; and in May 1841 these observations were considerably extended, and were thenceforth made regularly day and night at intervals of two hours.

The year 1841 was an important period of Quetelet's life. He thought that the time was past for individuals to promote the advancement of science by their isolated efforts, and that further investigations would need to be conducted by people associated together in academic bodies. In 1842 he drew up a set of instructions as to the choice of subjects for the reports. These instructions embraced Meteorology and Physical Geography and the Animal Kingdom.

In 1846 Quetelet published "*Lettres à S.A.R. le duc régnant de Saxe Coburg sur la théorie des probabilités appliquées aux Sciences Morales et Politiques*," which was reviewed by Sir John Herschel in the '*Edinburgh Review*.' Soon afterwards he published a work entitled "*Du Système Sociale et des lois qui le régissent*."

The Revolution of 1848 turned Quetelet's thoughts to political questions; and in 1849 he read to the Academy a new note, entitled "*Fragments sur la manière dont il convient d'envisager les Sciences Politiques et sur l'intervention du gouvernement dans les affaires des particuliers*." He also presented to the literary section of the Academy a '*Note sur la Nature des États constitutionnels, et sur quelques principes qui en dérivent*.'

Quetelet had in 1841 organized a general system of observation of the periodical phenomena of vegetation. Five years later he attempted to solve the question as to the influence of temperatures on these phenomena; and he was led to appreciate the influence of heat, not according to the sum of the mean daily temperatures, as did Réaumur, but by the sum of their squares.

The results of these researches on the electricity of the atmosphere appeared in 1849. Two years afterwards Quetelet made an important investigation on the shape, size, and velocity of atmospheric waves, according to the observations made in June, July, and August 1841, and of the system of atmospheric waves of Central Europe, according to hourly observations of the summer solstice of 1841 and of the winter solstice of 1843.

This work on atmospheric waves was an important step in meteorology, and paved the way for the recent labours in international meteorology, to which we owe the remarkable law of tempests of M. Marié-Davy. The researches on the temperature of the earth, of which the

accounts were first inserted in the 'Mémoires' of the Academy, and those on the atmospheric waves, which had appeared successively in the 'Annales' of the Observatory, were afterwards united with other works on meteorology, and published under the title "Sur le Climat de la Belgique."

Quetelet married in 1825 a daughter of M. Curtet, a French physician, and niece of the well-known chemist Professor van Mons, a highly accomplished lady, by whom he had a son and a daughter. He was very hospitable, and entertained at his house persons of distinction who came to Brussels—artists, savants, literary men, and politicians of all parties.

In July 1855 he was seized with a fit of apoplexy, which was pronounced by the physicians to be serious. His memory was much injured by it, although after a week or ten days he wished to resume work; and in the September following he was able to be present at the public Meeting of the Section of Fine Arts.

He continued to work during the remaining years of his life; and, in fact, when misfortune came heavily upon him by the loss of his wife, his daughter, and several of his grandchildren, work became his only consolation.

His son, M. Ernest Quetelet, had now taken the direction of the Observatory, and Quetelet occupied himself with Meteorology, Physical Geography, and Statistics. He continued to preside at the Central Commission, and assisted punctually at the International Congresses of Statistics, which were held in the great capitals of Europe. Six months before his death he made the fatiguing journey to St. Petersburg in consequence of a pressing invitation from the Grand Duke Constantine, under whose auspices the Statistical Congress was to be held. Neither the fear of cholera nor the anxious entreaties of his family could deter him from this enterprise. On his return he seemed refreshed, having been pleased by his reception. About this time also he had been made an Associate of the Academy of Moral and Political Science of the Institute of France; and ten days afterwards, in a congratulatory address sent to the Royal Academy of Belgium on the occasion of the hundredth anniversary of its foundation, the Academy of Sciences at Berlin proclaimed him the founder of a new science.

To the last he was punctual in fulfilling his duties as Perpetual Secretary of the Academy. On Monday, February 2, 1874, although already suffering from the attack of bronchitis which carried him off a fortnight later, he was present at the Literary Section. On the Thursday he went for the last time down to his study, and was with difficulty prevented from going to the Meeting of the Fine-Art Section. He became rapidly worse, and expired on the 17th of February.

PHILIPPE-ÉDOUARD POULLETIER DE VERNEUIL was born at Paris on the 13th of February, 1805. He was educated for the magistracy, but the events of the year 1830 interfered with his plans. It so happened that just at this period of indecision about his future career geology was making a great advance. The fact was now becoming recognized that the earth's crust, far from having remained unchanged from remote antiquity, had undergone upheavals and fractures which had repeatedly caused alterations in the surface. In addition to this, even the relative ages of these different phenomena had been estimated. De Verneuil's interest was engaged by these results, and he studied under Élie de Beaumont the methods of investigation of geology; and resolved not merely to be a passive student of the works of others, but to devote himself to the extension of the science. With this view he made up his mind to travel, and selected Wales as the place of greatest interest since the publication of the researches of the two celebrated geologists Sedgwick and Murchison. These latter had recently established a certain order of superposition in the very thick group of the most ancient strata, which had hitherto been confounded under the general name of "Transition Rocks."

He next travelled in the East; and on the way to Turkey, on the Danube, fell in with some sympathetic companions, and with them he travelled through Moldavia and Bessarabia to Odessa, thence on to the Crimea and to the frontiers of Circassia, and later on to the Bosphorus.

He now published a memoir on the Crimea, which was supplemented and made more complete by a collection of fossils belonging to new and interesting species, which were described by M. Deshayes. Through the private instruction of this savant De Verneuil became intimately acquainted with the fossil shells, a subject of so much importance to stratigraphical geology.

In the year 1838 De Verneuil paid special attention to the lower strata of the Bas-Boulonnais district, and thereby acquired considerable authority in determining the fossils of the ancient rocks. It was on this account that when Messrs. Sedgwick and Murchison wished to compare the most ancient formations of the districts of the Rhine and Belgium with those of England, they invited De Verneuil to accompany them in their exploration. In the memoir they afterwards published they acknowledged the great assistance afforded by their companion in placing at their disposal his rich collections.

In conjunction with M. d'Archiac, De Verneuil published in 1841 a description of the fossils of the oldest deposits of the Rhenish Provinces. The work is preceded by a general survey of the fauna of the so-called Palæozoic rocks, and is followed by a table of all the organic remains hitherto met with in the Devonian System of Europe.

The results of this journey were so satisfactory that shortly afterwards Murchison again requested De Verneuil's company when he was plan-

ning the exploration of Russia. In the course of three summers, Messrs. Murchison, De Verneuil, and De Keyserling examined an area equal in extent to more than half Europe. They took different routes, meeting occasionally to compare notes.

The important work devoted to Russia in Europe and to the Oural Mountains, and accompanied by geological maps, appeared in 1845. The introduction of the Permian formation into the science was one of the chief results of this exploration. The whole of the second volume of this book is the work of De Verneuil, assisted by De Keyserling as far as the Palæozoic fauna is concerned. That part relating to the Secondary fauna was intrusted to D'Orbigny. Taking a general survey of the fauna of the four Palæozoic systems, the author shows that organized beings follow each other there in the same order as in the other countries of Europe.

De Verneuil next turned his attention to the New World. The North-American geologists had been working hitherto quite independently of those of Europe. They had ascertained the remarkable development of the ancient strata in that quarter of the globe, so remarkable for their immense thickness as well as for the considerable area they cover—no less than 35 degrees of longitude by 15 degrees of latitude. There were then no data for connecting the two systems, owing to the separation of the two continents by several thousand miles.

Scarcely was the publication of the results of the Russian expedition completed when De Verneuil undertook to supply this great want. The task before him was no less than to follow and compare on the two distinct continents the sedimentary deposits from the oldest fossiliferous strata to those containing coal.

As a foundation for this labour he had only those species which he had studied in local collections, or which he had himself found. He established the fact that even in such remote countries the first traces of life manifest themselves by nearly similar forms; and there is, indeed, a striking agreement in the order of their succession.

This notice on the parallelism of the Palæozoic strata of these two continents remains a standard work in spite of the constant advances of the science, and is perhaps the masterpiece of De Verneuil.

His next labours were in Spain. De Blainville, who did not believe in the universality of the laws of Palæontology, engaged him in this enterprise. Though the order of succession of the strata of Northern Europe and America were well established, this great naturalist supposed that in Spain, especially towards the South, the order of succession of the fossil strata must be reversed, or at any rate modified.

Between the years 1849 and 1862 De Verneuil made no less than twelve journeys in the Peninsula, sometimes alone, sometimes in company with M. Edouard Collomb, well known for his works on ancient glaciers, and sometimes accompanied by young naturalists desirous of

gaining instruction. In these various journeys De Verneuil collected a great number of fossils, and the laws of Palæontology already established received striking confirmation.

A geological map of Spain was published after these laborious excursions, besides some memoirs of great interest, especially one on the Primordial fauna.

De Verneuil had been elected in 1854 free Member of the Académie des Sciences. He was also a Member of the Royal Society and of other foreign Academies.

In his latter years he suffered from a weakness of sight.

He possessed singular clearness of judgment and freedom from prejudice, and could discuss with calmness and equanimity opinions directly opposed to his own.

In character he was extremely benevolent, and many acts of kindness are recorded of him. His modesty of disposition inclined him to prefer dwelling rather on the discoveries of others than on his own; and, in fact, it is not improbable that some of his fellow workers may from this very circumstance have failed to appreciate his full merit.

During his last illness, which was of three months' duration, he continued to take a lively interest in scientific and other questions. His cheerfulness never forsook him; and he died calmly on the 29th of May, 1873, at the age of 68. He bequeathed his unique collection of fossils to the Gallery of the École des Mines.